"SOME PHYSICAL NETWORK CHARACTERISTICS OF ACUPUNCTURE POINTS AND MERIDIANS"

WILLIAM A. TILLER, Ph.D.

A. Introduction

As is now fairly well known, acupuncture is an ancient Chinese art of preventative medicine. The old practice was that people would go to their doctor about once every quarter and pay him to have their "circuits" checked and balanced using acupuncture techniques and stimulation. Because of this, they were supposed to be free from illness. If they happened to become ill, folklore tells us that the doctor paid them by treating them free of charge.

The early theory, at a fairly simple level, indicated that there were 12 main meridians in the body, very much like electrical wiring if you like, which acted as prime energy circuits for the body. There was thought to exist a deep inner circuitry connected in some way to the inner organs and body systems plus a shallow subsurface circuitry which was connected to the acupuncture points. It was felt to be essential for the health and wellbeing of the body that there be sufficient energy in these circuits and that they all be balanced with respect to each other; i.e., that there be an equalization of energy between the various meridians of the overall system. The energy flowing in the circuits was thought to be a fluid called "Chi" (Qi or Ki have also been used). These were thought to be the key aspects of the situation and the function of the acupuncture stimulation was primarily to take energy out of one limb of a circuit and put it into another; i.e., to shift these energies around so that one obtained a balanced system with continuously flowing energy.

Disease was thought to arise as a result of any major imbalance via what one might naively think of as an irrigation principle. Thus, if there wasn't enough energy flowing in one meridian, the body systems associated with that circuit had an altered energy terrain and the environmental energy fields were such that the soil became more favorable as a nutrient for bacteria to grow and thrive. This altered energy condition led inevitably to manifestations of disease at the physical level.

In more recent times, we have become aware of the rather remarkable application of acupuncture to anesthesia and perhaps the even more remarkable observation that the patient undergoing a major operation may be eating food such as an orange. This latter seems to be in gross violation of presently accepted ideas of necessary sterilization conditions in an operating room. Because of the Western focus on applications to anesthesia, models of structure and functioning of the meridian system have begun to localize around equation with the nervous sytem. However, it has also been postulated that this meridian system of the body is a fourth circulatory system of the physical body distinct from and on an equivalent level with the blood, the lymph and the nerve systems. We should keep our minds open to this larger possibility rather than try and squeeze all the emerging data into the more limited model of

relegation to another behavior characteristic of the nervous system.

The purpose of the present paper is to focus attention on some of the general network characteristics and functions of the meridian system as revealed by some research in other countries. This is not intended to be a comprehensive review but rather is a presentation of some of the less accessible material in this field that has recently come to the author's attention. The next section deals with some of the relevant work being carried out in Russia by V. Adamenko ([1,2]). This is followed by some of the Korean work by Kim Bon Han([3]). Finally, the closing section will deal with a correlation of the major aspects of these works and the suggestion of a model for the efficacy of specific acupuncture point stimulation on the functioning viability of specific body organs or systems.

B. Some Russian Work

Using a special resistance measuring device called a tobiscope [1,2], the Russians have located a network of low resistance points on the surface of the body which is in one-to-one correspondence with the acupuncture points on the Chinese charts. The device, illustrated in Fig. 1, consists internally of a bridge circuit so arranged as to be balanced by the normal skin resistance and unbalanced when making contact to an acupuncture point. The electrical signal due to the imbalance is applied to a D.C. amplifier which boosts the signal so as to activate a light bulb located in the front portion of the device (in other devices, the signal activates an audio speaker). This device is held in one hand (making contact with the metallic base) and the point is applied to the skin of the subject while the other hand of the operator is in contact with a different portion of the patient's skin. Thus, an electrical circuit is made from the base of the tobiscope, through the body of the operator, along the body of the subject to the tip of the tobiscope, and, via internal connections, to the base of the

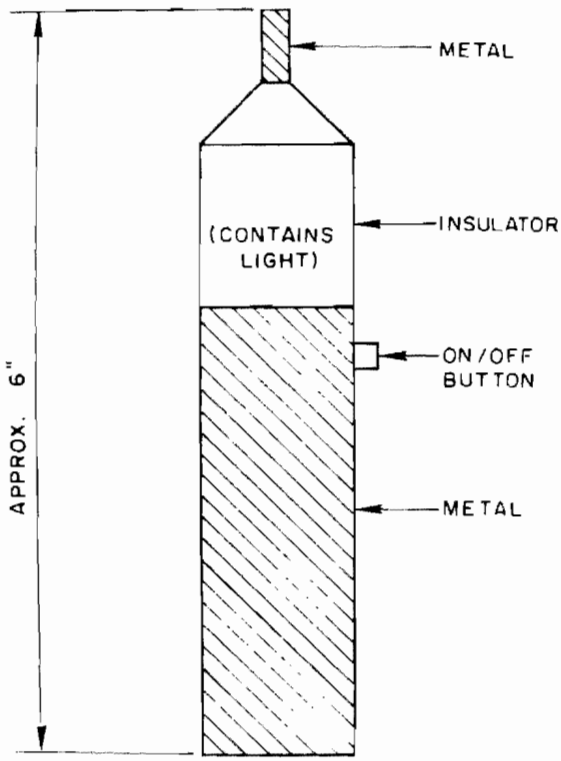

Fig. 1

RUSSIAN "TOBISCOPE" (1971)

Schematic drawing of Adameko tobiscope.

device. Moving the point over the skin, at light pressure, a network of point locations are found that cause the light to be activated in the device. A shift of the tip by about 1 mm. removes the tip from these special network locations which locate the low resistance paths through the body. One also finds a network of such points on plants and animals.

The Adamenko[1] device operates on less than 1 microamp at 4 volts with the 3 transistor D.C. amplifier being very stable over the voltage range of 1.3 to 3.5 volts. The input resistance is about 4-5 x 10^6 ohms and the device needs dry skin to be effective in locating the acupuncture network points (wet, salty skin leads to surface shunt paths). He finds that a resistance of about 5 x 10^4 ohms exists between these network points and that

the value increases by a factor of 2 to 3 during sleep. Over the same length of normal skin between two network points, the equivalent resistance is in the range~10^6 ohms. At present, the Soviets are investigating an A.C. device and are finding interesting results in the region of 10^3 Hertz. Interestingly enough, this author finds the resistance ratio between normal skin and acupuncture points to also be a factor of about 10; however, the value of the resistance is larger by a factor of about 5.

The D.C. resistance between any two acupuncture points on the body differs by less than a factor of two suggesting that almost all of the resistance is embodied in the thin layer of epidermis at the skin surface. A similar range of resistance variation occurs due to emotional change, mental concentration, light stimulus, etc. In the case of emotional excitation, the points vary in diameter (as revealed by conductivity area) and there is the possibility of the areas overlapping one another to form high conductivity regions.

An alternate circuit, for point location, is that illustrated in Fig. 2[4]. Its major drawback is that it draws too much current and produces some polarization effects. A circuit which avoids this difficulty and also produces an audio signal is presented in Fig. 3[5]. In this case, less than 1 microamp of current is utilized and the frequency of the sound increases as the conductivity of the area increases.

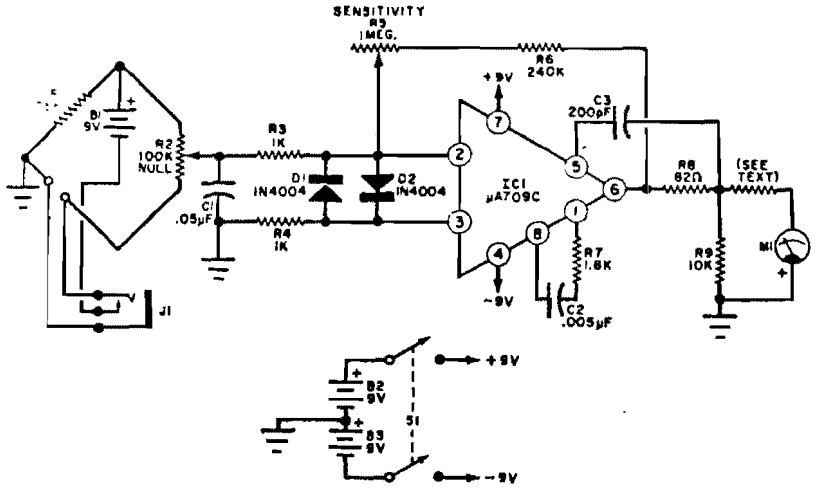

Fig.2. The low-level d.c. error signal generated in the bridge is amplified by the high-gain IC amplifier and displayed on the meter.

PARTS LIST

B1-B3—9-volt battery
C1—0.05-μF capacitor
C2—0.005-μF capacitor
C3—200-pF capacitor
D1,D2—1N4004 (or any silicon diode)
IC1—Integrated circuit (Fairchild μ1709C). See text.
J1—Modified closed-circuit jack. See text.
M1—0-1-mA meter with series resistor (2500 to 3000 ohms) to measure 3 volts.
R1—75,000-ohm, ½-watt resistor
R2—100,000-ohm potentiometer
R3,R4—1000-ohm, ½-watt resistor
R5—1-megohm potentiometer (miniature preferred)
R6—240,000-ohm, ½-watt resistor
R7—1800-ohm, ½-watt resistor
R8—82-ohm, ½-watt resistor
R9—10,000-ohm, ½-watt resistor
S1—D.p.s.t. switch
Misc.—Eight-pin TO-5 socket (for IC1), two 1"-square pieces of heavy copper or two large foreign coins, pair of bicycle clips, length of insulated wire, battery clips (3), case as desired, mounting hardware, etc.

Fig. 2

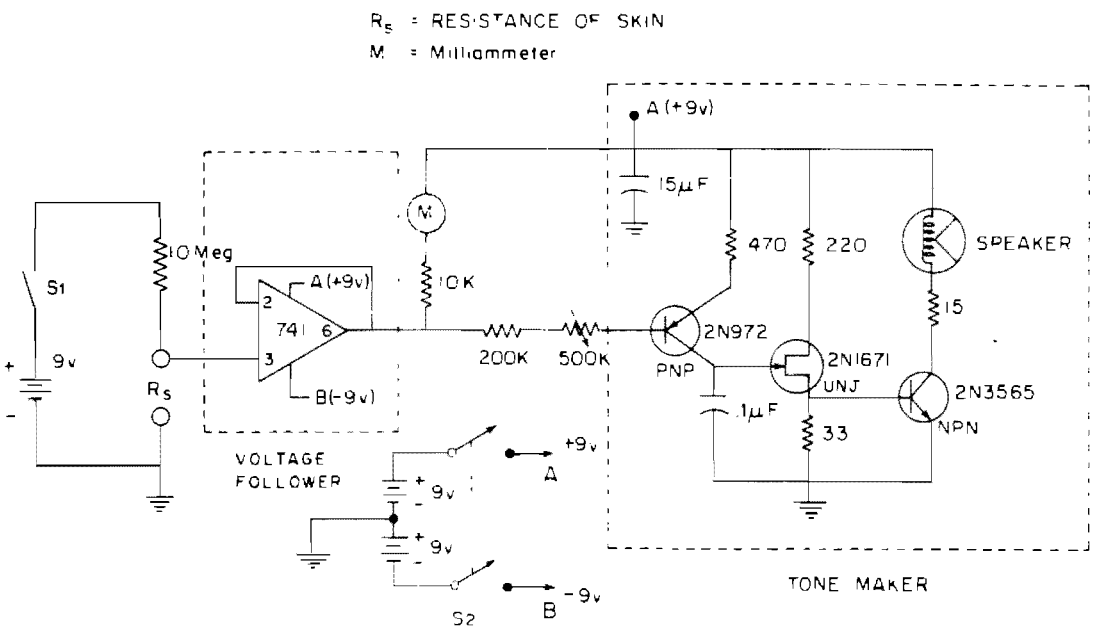

Fig. 3 Circuit diagram for an audio signal acupuncture point locator.

Adamenko[1] has investigated the relationship between the conductivity of the network points and certain states of hypnosis of the patient. His results are given in Fig. 4, where the different states of consciousness are listed along the abscissa as: (1) ordinary working state, (2) sleep with eyes closed, (3) sleep with eyes open, (4) suggestion of hallucinations, (5) "artificial reincarnation" (a particular hypnotic condition), and (6) work in the "reincarnation" state. The four graphs show variations in four groups of subjects ranging from control group A (those not hypnotizable) through B, C, and D in increasing order of hypnotizability. As seen from the graphs, there exists a certain relationship between the patient's hypnobility and the character of the conductivity variations. In the control group, no conductivity variation has been recorded which indicates the absence of emotional reactions to the hypotist's words. However, in the case of ordinary emotional states, these patients exhibit conductivity variations.

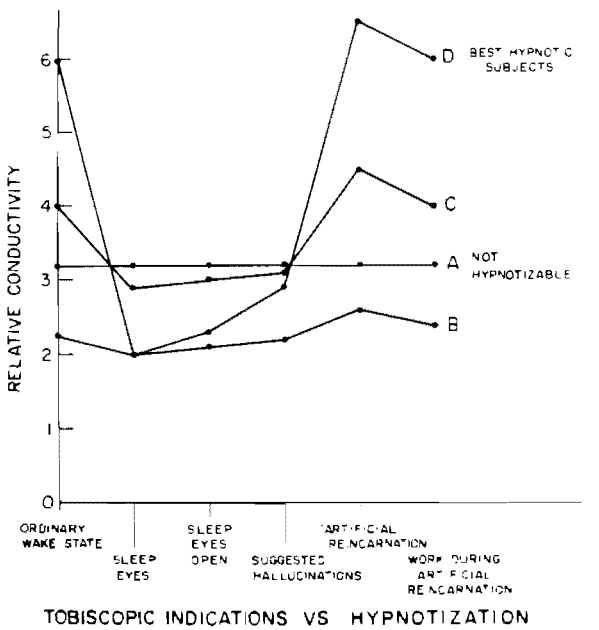

Fig. 4 Relative conductivity indications versus hypnotic state of the subject.

Adamenko[1] has also discovered that a voltage signal can be detected between two network points

provided two different types of metals are used as electrodes. On dry skin using plated circular electrodes (5-7 mm diameter), a Ni - Ag combination yielded a potential difference of about 50 mv. At skin locations where such points are absent, the potential difference is close to zero. Likewise, using the same electrode material, Ni - Ni or Ag - Ag say, the potential difference is again close to zero. The greater is the work function difference between the two materials, the greater is the voltage developed. This suggests that we have a galvanic cell effect operating here. The current drawn from this battery is about 10 microamps. However, because this current level polarizes the electrodes, one is advised to use an impedance in the measuring circuit to reduce the current to levels below 2 microamps and then to amplify the signal for display purposes. In cases of emotional volitive excitation, the potential difference may increase up to 100 millivolts. Further, using parallel connections between several network points, the voltage obtained may be as high as 0.5 - 1.0 volts with a corresponding increase in saturation current.

The Soviets find that, as the electrode area, A, increases, the developed voltage increases. They also find that the amplitude of an A.C. pulse is diminished as A increases (see Fig. 5) which probably represents an averaging phenomenon wherein the A.C. signal arises only at the acupuncture point (less than 1 mm. in diameter) in the central region of the electrode.

Adamenko[11] performed an interesting healing experiment utilizing what they call the "semiconductor" effect. One often finds, when measuring the resistance between symmetrical points on the left and right sides of the body, that the resistance is different in the forward (R) from the reverse (R') direction (just like a semiconductor material which contains p/n junctions). If the person is healthy relative to that meridian, or particular organ in that meridian, then the resistances will be the same (R = R'). However, if the person is ill relative to that organ or relative to an organ which is associated with that meridian, then one will find a difference in resistance ($R \neq R'$). This difference, ΔR, is called the semiconductory effect.

Adamenko used a manual healer[6] in the healing experiment who projected energy via his hands located a short distance from the patient. The semiconductor effect was measured on both the patient and the healer before the experiment and also after the experiment. The data given in Fig. 6 was obtained. We can suspect that some

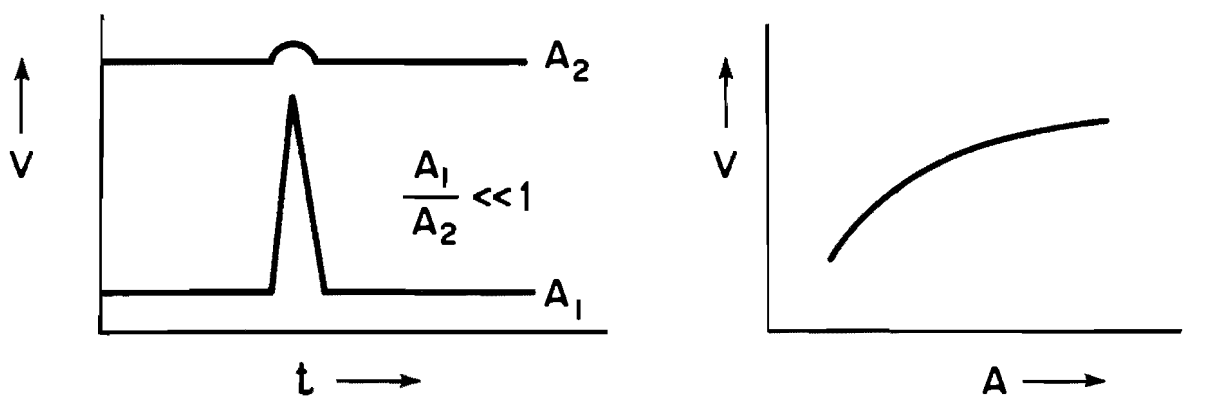

Fig. 5 Schematic representation of time variation of electrode voltage for electrodes of different area.

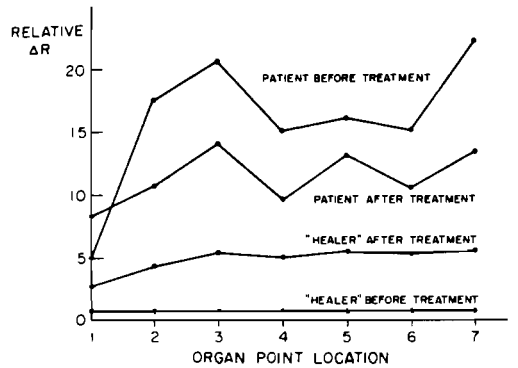

Fig. 6 Representation of the "Semiconductor" effect observed in paranormal healing.

energy was transferred from the healer to the patient because the value of ΔR had decreased for the patient. However, we note that the healer's circuits have become somewhat unbalanced in the process (temporarily). This suggests that the healer gave up a particular kind of energy in a particular location of his body in order to bring into closer balance the circuitry of the ill individual. This appears to be a new type of energy that we have heretofore been unable to monitor in any numerical or objective way. The author has tried a similar experiment with a patient and healer while monitoring the acupuncture points and found similar results except that there was only a small change in the healer and ΔR for the patient changed over a period of a week after treatment eventually decreasing to zero. During this time period both R and R' increased by a factor of 2.

It has been noticed that when a serious imbalance exists in the meridian circuitry and a needle is placed into the appropriate point, a force (almost like a suction force) holds the needle into the point so that, if one tries to withdraw it, the skin pulls up around the needle and it is not easily withdrawn. After the needle has remained in the point for a sufficient length of time to have brought about a temporary balance to the circuits, the needle may be withdrawn with no effort and the skin no longer pulls up around the needle. This suction force seems to be proportional to the degree of imbalance; i.e., to ΔR.

There are, at present, several ways in which one can produce point stimulation and it appears that, to bring about balance to the circuits, all one needs to do is stimulate sufficiently the acupuncture points. In increasing order of effectiveness, the various techniques are: (1) chemical stimulation, (2) manual massage, (3) acupuncture needles, (4) electrical energy injection (requires sophisticated understanding), (5) laser beam (requires sophisticated equipment and understanding), and (6) an injection of "spiritual" energy from a psychic healer. This latter seems to be the best procedure for bringing about bodily balance (the energy does not need to be directed at a specific point or set of points). Using method 5, the Russians have found that when a mild intensity laser beam is directed at the acupuncture point above the upper lip, it will immediately stop an epileptic seizure.

An additional technique developed by the Russians for monitoring various physiological states of humans, animals and plants is called Kirlian photography after its inventor Semyon Kirlian[7]. Using this device, one can observe flares of energy emitted from specific points of the organism. The flares change in both intensity and color depending on the emotional or mental state of the organism and on its state of physical well being. Using these flare characteristics, it has been possible to detect the onset of disease before it is manifest by conventional monitoring techniques. One of the important observations relative to this article is that the major flare points are found to coincide in location with the acupuncture points on the Chinese charts. Since this technique has been discussed in detail by the author elsewhere[7], only a brief account will be given here.

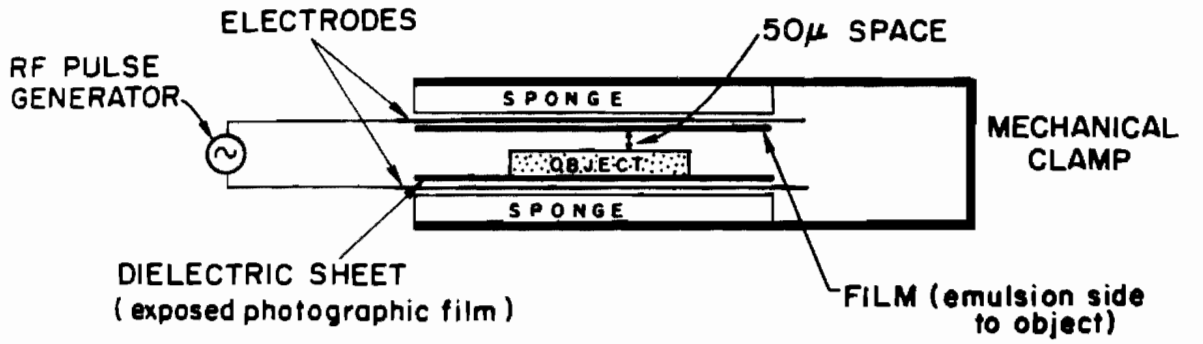

Fig. 7 Simple electrode device for taking Kirlian photographs.

In the simplest Kirlian device, shaped like a sandwich or parallel plate condenser (see Fig. 7), the object (a leaf, say) is placed between the two plates to which voltage is applied. This voltage is pulsed with a pulse width of 10^{-6} to 10^{-3} seconds, a pulse height of 20 KV to 100 KV and R.F. under the pulse of 75 KH to 3 MH. The pulse repetition rate is 60 H. The high electric field ($\sim 10^{7}$ V/cm) produces a discharge phenomenon that is thought to be a combination of cold electron emission from living systems and a bioplasmic energy emission from some other level of substance in the organism. It is felt that the electron work function varies over the surface of the leaf or the skin and that energy emission occurs most strongly from these low work function points (acupuncture points). Using the electron emission idea, their acceleration in the strong field and their collisions with molecules in the air gap produces a conversion of electrical energy to light energy and these photons expose the film. This description is a little naive but it will serve at present to make the reader feel comfortable with the phenomenon.

On the photographs, one sees an image of the structure of the surface plus a surrounding halo due to a high frequency discharge (see Fig. 8). Both the dimensions of the halo and the overall brightness of glow change in accordance with changes in the physiological state of the organism. Different sections of skin surface are found to emit radiation that results in characteristically different colors: the heart area shows as dense blue; the hip shows as olive; the forearm shows as greenish light blue. As a result of sudden emotional excitement (fear, pain, etc.), the color of the related section changes.

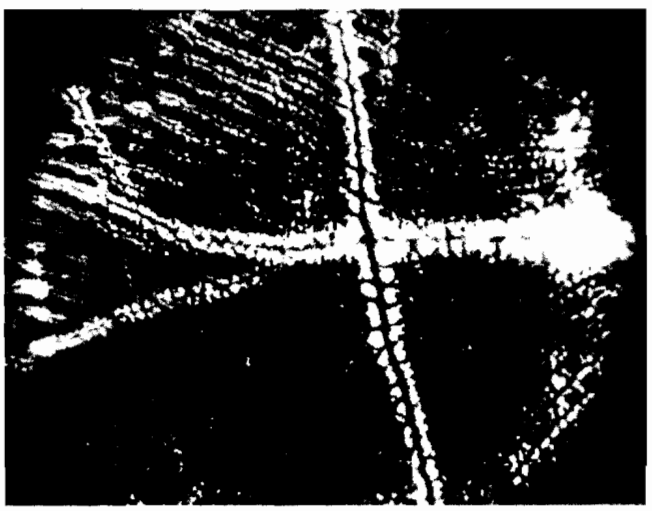

Fig. 8b
b) Kirlian photograph of skin on the human palm (courtesy of V. Adamenko).

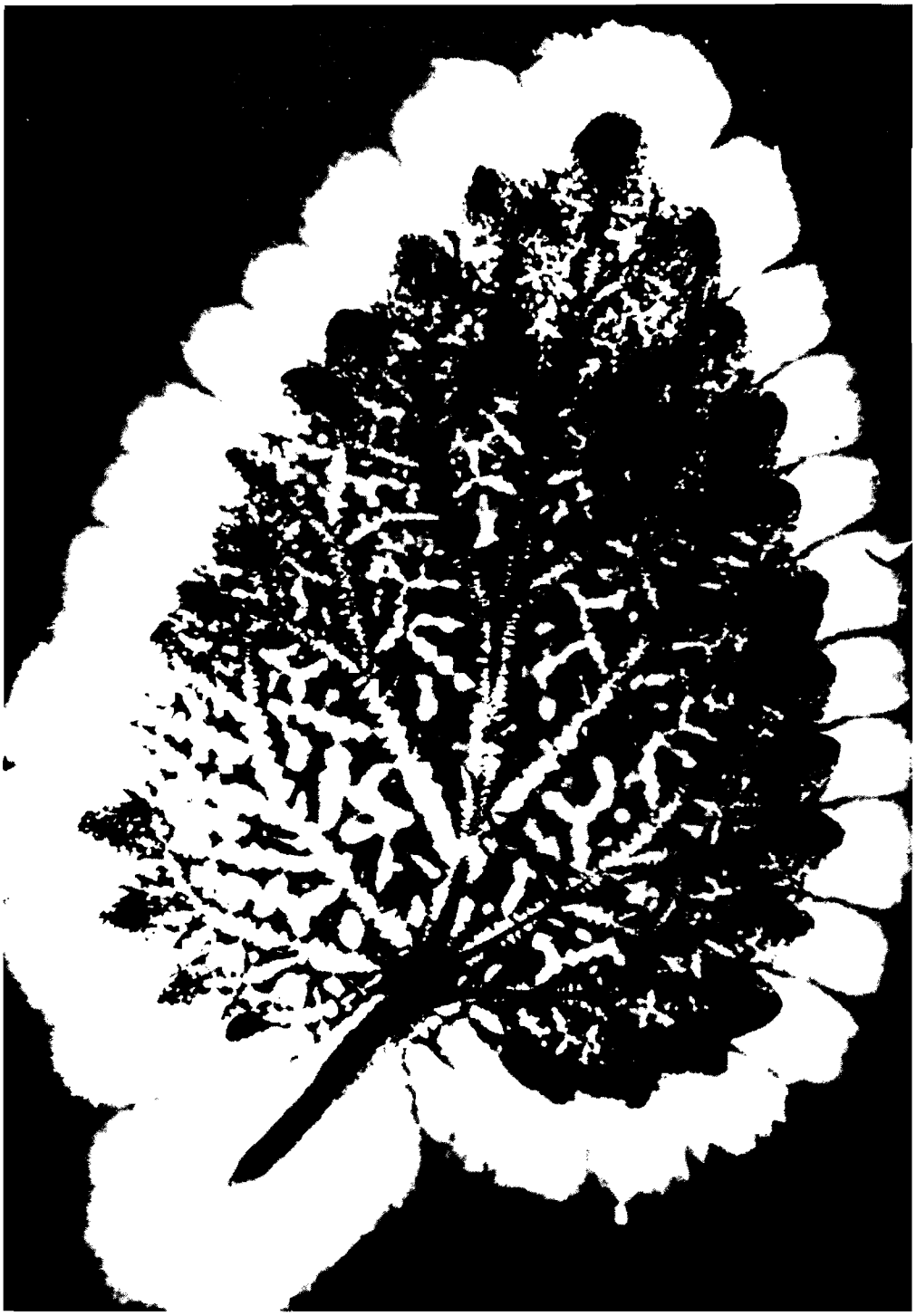

Fig. 8a

a) Kirlian photograph of a whole leaf (courtesy of V. Adamenko).

It has been found possible to develop transparent electrode systems and techniques for transferring information patterns from one side of a dielectric sheet to the other so that continuous visual monitoring of the energy emission patterns can be made. A simple device for this mode of operation is illustrated in Fig. 9. Here, one uses a transparent elastic dielectric and a transparent electrode so that the transfer of electron information to light information occurs and the light passes through the device to a waiting eye or camera, etc. The Russians are building garments of this material so that they can directly monitor the physiological changes taking place in the body during various experiments (both medical and parapsychological).

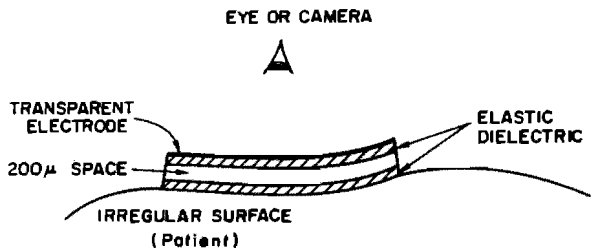

Fig. 9

Transparent electrode device for continuous monitoring of energy patterns.

Using a transparent electrode device, they have photographed the palm of a healer's hand in the process of projecting healing to a patient. They find that, as he is warming up, many points on the palm are flaring. As he becomes more attuned, the number of flare points decreases and the area of discharge around any flare point increases. Eventually, the condition is reached where one sees only a brilliant luminescent disc (dime-size) in the center of the palm. This is when the healer is completely attuned and the patient says that he feels energy (or heat) in his body. Thus, we once again see a correlation between acupuncture points and the radiation of this healing energy whose nature we know practically nothing about.

In the past few months, several high voltage photography devices have been put into operation in this country; however, there has been little time to check out the major Soviet experiments and our equipment is probably more crude than theirs at this stage of development. Using the Stanford device, Figs. 10 and 11 illustrate energy emissions

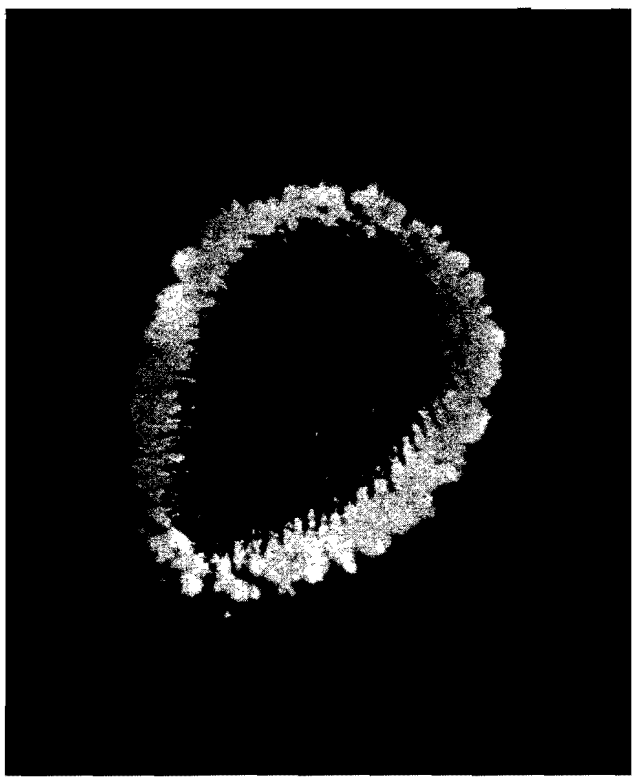

Fig. 10

Photograph of a finger in contact with film using the conditions: 100 μsec pulse width, 20 Hz repetition rate, 2 sec exposure.

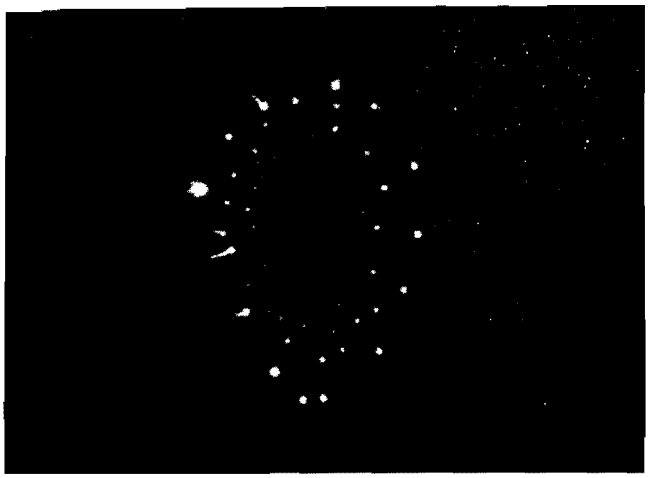

Fig. 11

Photograph of a finger in contact with film using the conditions: 100 μsec pulse width, 1 Hz repetition rate and a single pulse exposure.

from a finger for different pulse widths. We note that, at small pulse time, the energy emission is from a series of points on the finger (which may be part of the acupuncture network). The buildup during longer emission time leads to a rather uniform halo effect around the finger. To illustrate the change in these emissions with the physiological state of the individuals, Figs. 12 and 13, taken by Thelma Moss on the UCLA device [8], represent the changes associated with alcohol ingestion. This is a very powerful tool for minitoring the human organism and reveals another characteristic property of the acupuncture point system.

Fig. 12

Kirlian photograph using finger contact; subject had ingested 2 oz. of alcohol.

Fig. 13

Kirlian photograph using finger contact; subject had ingested 12 oz. of alcohol.

C. The Kim Bong Han Experiments [3]†

Before describing the main experiments on structure and functional behavior of the meridian system, it seems pertinent to discuss an experiment that bears on the idea which says the energy "Chi" that flows in the meridian system does so via a fluid type of motion. After describing this experiment, we shall proceed in a more regular way to discuss the massive sequence of experiments conducted in North Korea under Professor Kim Bong Han's direction.

†Most of this section has been extracted word-for-word from reference 3.

1. Fluid Circulation in Subsurface Meridians

To observe the circulation of fluid in some of the subsurface meridians, P^{32} (as $K_2HP^{32}O_4$ or $NA_2HP^{32}O_4$ in the amount of 5 - 100 microcuries) was injected into an acupuncture point in the skin of the inner side of the femur and the abdominal wall of a rabbit and, after a lapse of 30 minutes to 6 hours, a definite portion of skin containing the meridian and many acupuncture points was cut off and the location of the radioactive material determined using a dosimeter and autoradiography. In Fig. 14, one can see the distribution of P^{32} (100μc) three hours after its injection into the acupuncture point in the abdominal wall. We see that the radioactivity is concentrated at the other acupuncture points along that meridian although a small amount has spread to the surrounding tissues. Positions with higher radioactivity can be seen on a line which runs

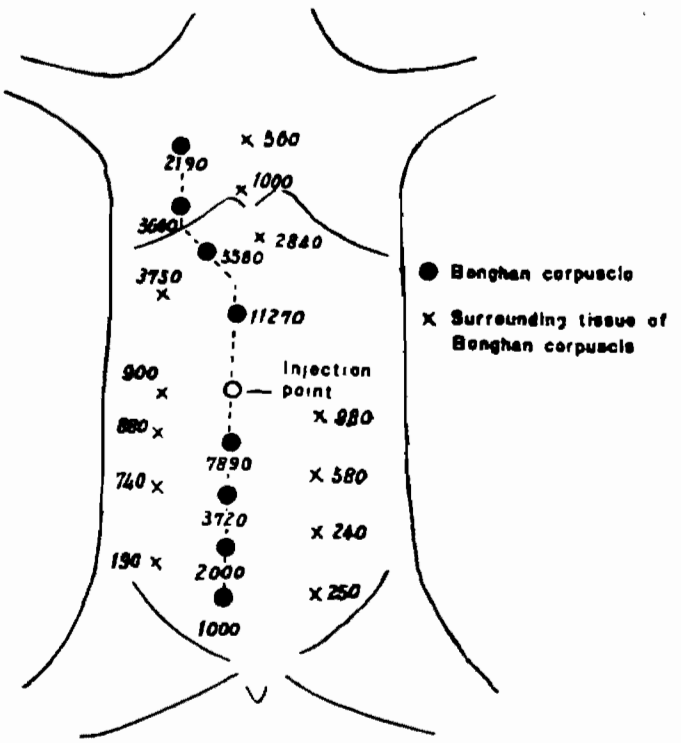

Fig. 14

Distribution of P^{32} (100 uc) three hours after its injection into a B-corpuscle (acupuncture point) located in the abdominal skin.

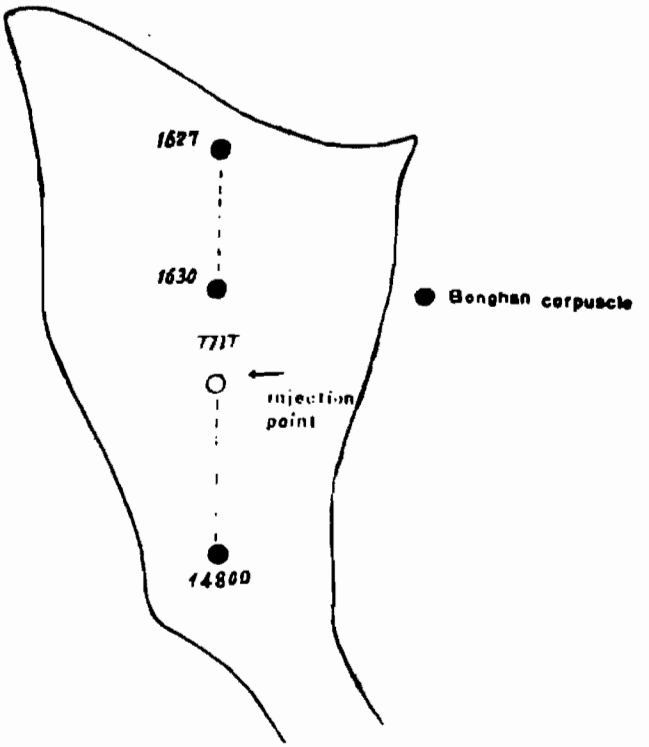

Fig. 15

Distribution of P^{32} injected after the cut of the tissue between B-corpuscle.

straight along the skin, then slightly sideways near the chest and then straight again. When P^{32} was injected into the blood vessel (ear vein), almost no difference was detected between the tissues of the meridian system and those around it.

They next cut the tissue containing the meridian at one point and injected into the immediately adjacent acupuncture point on the cranial side of the cut. As can be seen from Fig. 15, the ratio of the counts on the cranial to the caudal side of the cut was about 5 - 6. In view of the fact that when P^{32} is injected into an acupuncture point, it is liable to diffuse in the tissues surrounding it, they determined the radioactivity in the skin around an acupuncture point injected with P^{32}. As can be seen from Fig. 16, the larger amount of the injected P^{32} migrated along the meridian. Using autoradiography, they confirmed the coincidence of points of high radioactivity along a line with acupuncture points on a single meridian (determined by using a microscope and a staining technique). The locus of the high activity line (shadow) was found to be completely different from the path of blood, lymphatic and nerve vessels observed in the skin specimen. When the radioisotope was injected into a deep inner meridian, it was observed to circulate only in a certain direction along the meridian rather than in both directions.

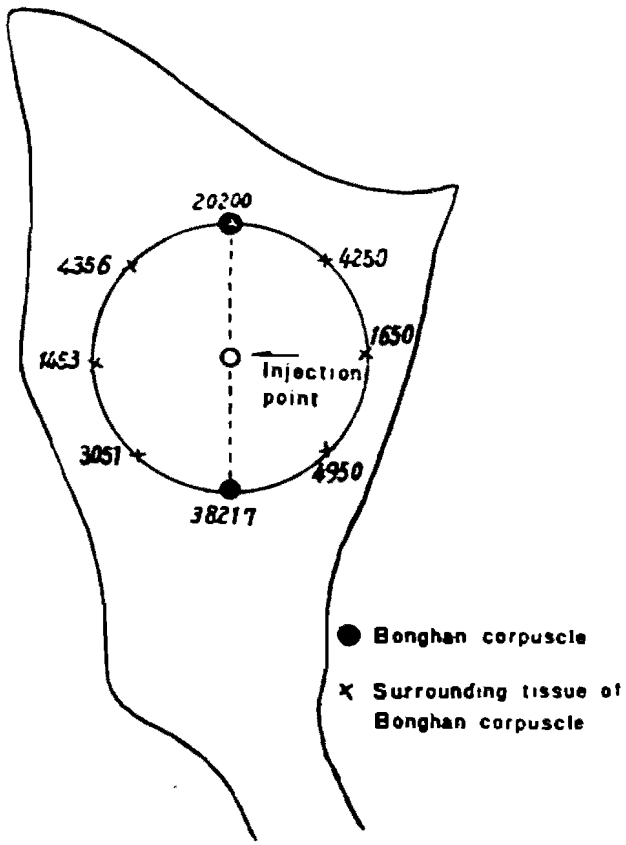

Fig. 16

Radioactivity of the surrounding tissues after injection of P^{32} (100 uc) into a B-corpuscle.

2. An Atomical and Histological Structure

Using anatomico-histological and histo--physiological methods on rabbits, some other animals and man, the existence of several major B-ducts (meridians or circuits) and B-corpuscles (active element of an acupuncture point) were discovered wherein every B-duct links B-corpuscles together and every B-corpuscle is connected with B-ducts. There are found to be four kinds of B-ducts:

(1) Internal Duct System - These ducts are found free floating in the vascular and lymphatic vessels (the ductules ramify so that the pathway of the containing vessels are completely followed). The Chi liquor flowing in the ducts generally follows the direction of the blood or lymph flow but, in some cases, it flows in the opposite direction.

(2)The Intra-External Duct System - These are found on the surface of the internal organs and they form a network which is entirely independent of the vascular, the lymphatic and the nervous systems.

(3)The External Duct System - These ducts run along the outer surface of the walls of the vascular and lymphatic vessels. They are also found in the corium and are the ones we are most familiar with in acupuncture.

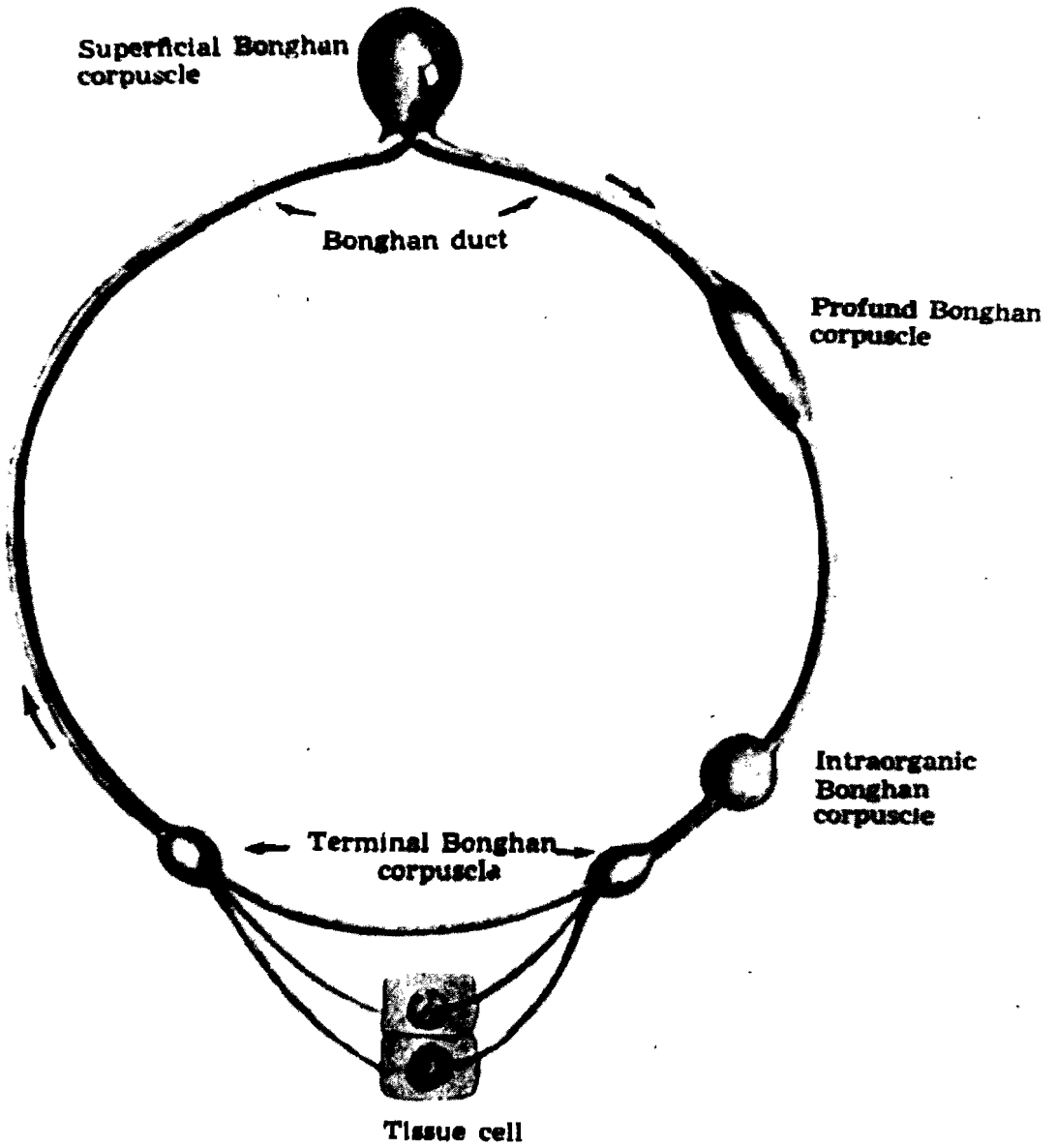

Fig. 17

Scheme of the circulation route of the B-liquor (Chi).

(4)The Neural Duct System - These are distributed in the central and peripheral nervous system running inside the central canal of the spinal cord and the cerebral ventricles.

The suggested scheme of the path of circulation of Chi (B-liquor) is as illustrated in Fig. 17. The following features appear to be relevant: (1) All tissue cells are situated on a closed path of circulation of Chi (B-liquor). (2) Every organism has not only one but many such courses of circulation

which are inextricably linked with each other. (3) A circulation course should always go through (a) tissue cells, (b) superficial B-corpuscle, (c) profound B-corpuscle, (d) intra-organic B-B-corpuscle, (e) terminal B-corpuscles, and (f) tissue cells again. (4) Communications between the B-corpuscles can be maintained by one to three of the above mentioned four duct systems. (5) The terminal corpuscle is linked with a certain number of tissue cells.

The different corpuscles are found to have some common features. The basic structure of the corpuscle consists of ramified, enlarged and anastomosed ductules. The B-duct in the corpuscle contains basophile granules, small nucleus-like and somewhat large, round nucleus-like structures. Cells with pale plasm are also found and the cytoplasm often contains many chromaffine granules. Reticular tissue constitutes the basis of the structure of the corpuscle and the corpuscle has an outer membrane.

Turning to the superficial B-corpuscle illustration in Fig. 18, it measure 100 microns wide and 300 microns long and is generally located in the corium at the top (but sometimes in the subcutaneous tissue). At the bottom, it is connected with a bundle of blood vessels and B-ducts. The corpuscles and tissues around it are loosely linked with each other and there is much fluid in the connective tissue. The exposed corpuscle is more transparent than the tissues around it and is of light yellow color. When dissected, semi-fluid, tacky liquid flows out of it.

Fig. 18

Model of the superficial B-corpuscle: 1. Hair 2. Epidermis 3. Radiation smooth muscle fiber 4. Outer layer 5. Inner substance 6. Superficial B-duct 7. Profound B-duct 8. Skeletal muscle.

The blood vessels and nerves of the superficial B-corpuscle are distributed in a special way. Around the corpuscle, the network of blood vessels is particularly developed, part of which branches into the outer layer. Blood capillaries, varying in caliber, occupy the bulk of the central part of the inner substance, heavily convoluting in a spiral form. These blood vessels, always filled with blood corpuscles, are in a very dilated state and contain not only erythrocytes but also equally stainable granules. These blood vessels are linked with those of the outer layer and run along the bundle of vessels outside the corpuscle. Although the nerve fibers are rather richly distributed in the tissue surrounding the corpuscle, they are relatively scarce in the outer layer. The nerve fibers penetrating into the smooth muscle-like tissue of the outer layer terminate there, twisting spirally. Some nerve fibers are found to enter the inner substance through the outer layer and ramify at their terminals.

When dye solution is injected into the outer layer of the corpuscle, reticulated or heavily convoluted B-ductules are noticed in the smooth muscle-like tissue. This solution, after passing through the B-ductules of the outer layer, flows downwards and runs into the external B-duct connected with the corpuscle and partially enters the inner substance and then flows into the internal B-duct. When the dye is injected into the inner substance of the corpuscle, it eventually runs

into the internal B-ducts of the blood vessels of the inner substance.

Proceeding with a very brief description of the other corpuscles, we must first consider those in the category of profound B-corpuscles and these are associated with the B-ducts. The external B-corpuscles which are mainly found around blood vessels, are connected at both their ends with external B-ducts and are lightly yellow or yellowish red in the living condition. The internal B-corpuscles are connected by the internal B-ducts in the blood and lymphatic vessels and do not stick to the walls but float in the blood current. They look colorless or semitransparent (slightly yellowish or lightly reddish). The cell elements are found to vary according to the kind of corpuscles. For instance, in those of the liver, one finds cell elements similar in structure to the liver cell. The intra-external B-corpuscles generally connect with ducts at both ends and are about 30μ - 100μ x 100μ - 500μ in size; however, larger corpuscles by a factor of 2 to 3 are often seen which are connected to three to seven ducts as a rule and they take fusiform or polygonal irregular form. The neural corpuscle looks light yellowish-white and semi-transparent and is of either oval or spindle form. This corpuscle is connected with two to four neural ducts in a bipolar or multipolar way. The intra-organic corpuscle means the corpuscle located in the internal and other organs and its outstanding feature is that it is the smallest in size and the simplest in structure among the B-corpuscles. Numerous terminal B-corpuscles are located in the organs, each of them being linked only with the cells within a definite range. The B-duct leaving the intra-organic B-corpuscle ramifies and reaches a number of minute intra-organic corpuscles (called the terminal B-corpuscles). the fine B-ductules running out from the terminal B-corpuscle are directly linked to the cell nuclei.

Turning now to consider the general structure of the B-ducts, they are found to be somewhat different from each other but have the following

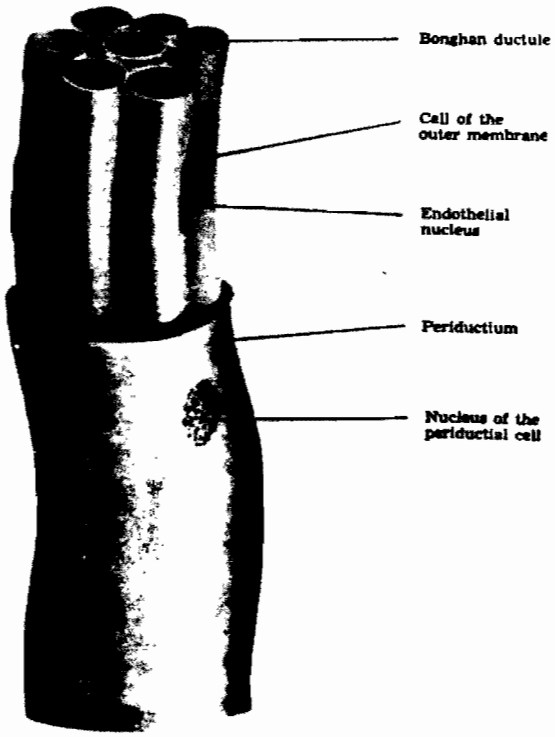

Fig. 19
Artistic rendering of a B-duct.

common features. A B-duct consists of a bundle of B-ductures, as illustrated in Fig. 19, the wall of which is formed of endothelial cells with peculiar rod-shaped nuclei which are intensively stained. The outer membrance of the ductule is composed of smooth muscle-like cells and fine fibers. Internal to the ductule, basophile granules and small nucleus-like structure are often found. One finds fibrous structures and amorphous substance between the ductules which are bound up in a bundle by periductium having cells with spherical or spindle-shaped nuclei and abundant cytoplasm.

The internal B-duct looks, under the stereo-microscope, like a yellowish milk-white thread and, in some cases, the flow of its contents can be observed. When a blood vessel is incised, a fine B-duct which is very soft and glutinous is found in it. The ductules comprising the duct are about 0.5μ and, in some cases, when greatly filled with

content are extended to 4μ. Sometimes, very thin ductules of about 0.1μ are found.

A blood vessel usually has 1 or 2 B-ducts in it and a larger number for large blood vessels. When a blood vessel or lymphatic vessel ramifies, so does the B-duct via one of two bifurcation methods - by dendroid ramification like the blood vessels or by division of the ductule bundle as in nerves. The flow of B-liquor in the duct generally coincides with the direction of blood flow but the reverse phenomenon is also observed; e.g., in the duct of the suprarenal artery, it flows against the current of the blood and goes out of the suprarenal body into the kidney through the internal B-duct of the renal artery. In addition, in the large blood vessels reaching viscera, it also flows against the current of the blood.

Perhaps even more striking is the fact that the B-ducts go in and out of the blood vessels penetrating their walls. This is frequently observed in the abdominal aorta, in the peripheral blood vessels as well as in the lymphatic vessels. This leads to the conclusion that the formation of the internal B-duct sytem is different from that of the vascular or lymphatic systems. The heart is situated in the center of the vascular system, but the internal B-duct system has no such center. All the B-ducts are not connected to form a single route but rather a number of different and specific routes with each route linking to a different organ. On the other hand, the blood circulation connects all the organs and tissues in one common route. Some organs can have B-duct connections with many circulating routes, others have less. The endocrine glands are linked with many circulating routs; likewise, the B-liquor from the ovary goes to the tissues of many organs. An example of the internal B-duct sytem in the cardiac cavity is presented in Fig. 20.

The internal-external B-duct system, independent of the paths of vessels and nerves, is distributed all over the body like a network. It is only slightly different from that of the internal duct system and

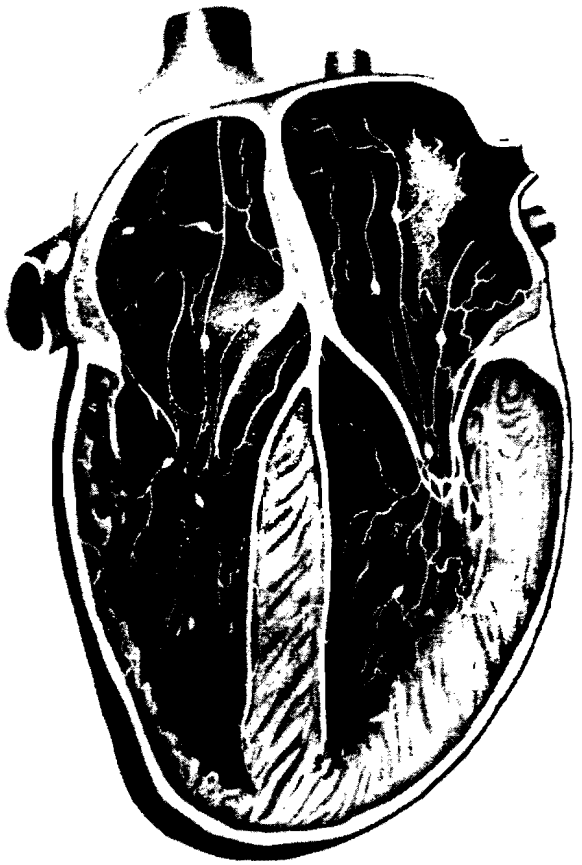

Fig. 20

Artistic rendering of the Internal B-duct system in the cardiac cavity.

is connected to it through the wall of the blood vessel. Its distribution shows a definite order though it is found in all parts of the body including the cervical, thoracal and abdominal regions thus forming very complex reticula. These ducts lie in a free state but they stick to the surface of the organs and the wall of the blood vessels only in the region where they branch off. The intra-external duct sytem of the liver is illustrated in Fig. 21.

The external B-ducts are also distributed throughout the body linking external B-corpuscles. Around the large blood vessels of the abdomen, for instance, the external B-ducts link B-corpuscles running in four to six lines. Running along blood vessels, these ducts send out branches to all internal organs including the heart, liver, gall bladder and suprarenal body.

Fig. 21
Artistic rendering of the Intra-external B-duct system of the liver.

A peculiar neural B-duct system is found in the nervous sytem. In the central nervous system, the neural ducts are distributed in the brain and spinal cord running in a free state through the central canal (see Fig. 22), cerebral ventricles and subarachnoid space along the circulating route of the cerebrospinal liquor. Some of the ducts are linked with the B-ducts under perineurium and with those between nerve fibers in the peripheral nervous system. Examples of the neural B-duct system are given in Figs. 23a and 23b. The neural B-duct in the central canal does not send out branches in accordance with the segmental ramifications of the spinal nerves but it usually gives off a branch in every two or three segments.

The neural B-duct system communicates with other B-duct systems; for instance, when dye is injected into the internal B-duct of the ovary, it reaches the neural B-duct, and when dye is injected

Fig. 22 Neural B-duct in the central canal of the spinal cord (Van Gieson stain, 400 x).

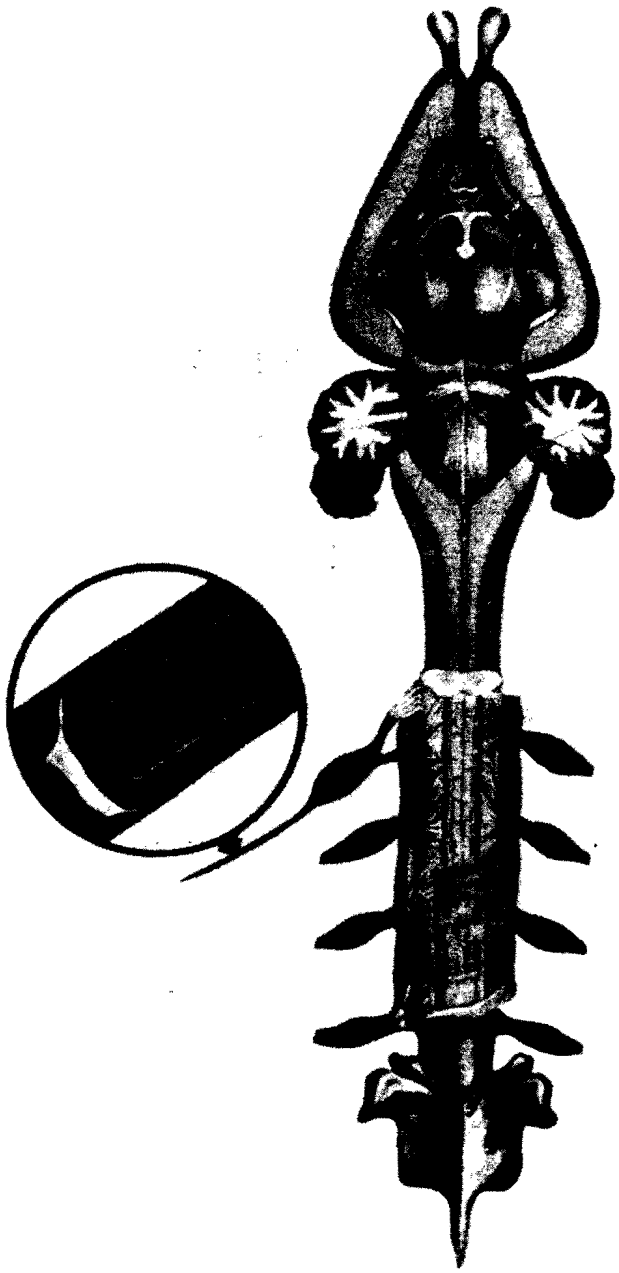

Fig. 23a a),b) Artist's rendering of Neural B-duct system. Fig. 23b

into the neural B-duct system, it moves to the intra-external B-duct system in the abdominal and thoracic cavities.

The various parts of the overall meridian system are related to each other to form an integrated system. For instance, the internal B-ducts penetrate the walls of the arterioles and venules and meet the external B-ducts at the intra-organic B-corpuscles. In the large blood vessels also, the internal B-ducts come outwards to be linked with

the inter-external B-ducts. The external and internal ducts are also connected with each other in the superficial B-corpuscles and the neural B-ducts are linked with the intra-external B-ducts. Thus, all four parts of the overall meridian system are linked.

When stain is injected into an intra-organic B-corpuscle, it reaches the cell nucleus and from there it flows out again from the cell through the fine B-ductule linked with the nucleus. In order to prove this, a B-duct was cut and the result was examined.

When an internal B-duct entering a parenchymal organ is severed, histological changes are noticed in the associated organ. When an internal B-duct in the portal vein is cut, the liver cell slightly enlarges in size and cytoplasm gets turbid in a day, karyolysis occurs in some cell nuclei, leading to the destruction of cells. Three days after the cutting, a serious vacuolar degeneration takes place in the parenchymal cells of the liver as a whole. When the external and internal B-ducts distributed in the kidney are severed, necrosis of the convoluted uriniferous tubules and of the renal corpuscles is observed in the cortex of kidney, and the uriniferous tubules lose their nuclei thoroughly, while preserving their form. The epithelial nuclei of the uriniferous tubules in medullary substance are either partially destroyed or disappear completely. In the case of the severance of the external and internal B-duct located in the suprarenal body, the terminal B-ductules connected with nuclei in zona glomerulosa disappear in the early stage, and the nuclei become pyknotic and are destroyed or lost. The basophile structures, large or small, slightly stained with basic dyes, appear in the regions where the cells were destroyed.

3. Electrical Effects

An electrophysiological analysis was made of the corpuscle excitation process or response to stimulation and definite bioelectrical features were noted. They cut off a small piece of skin from a rabbit and put it in a damp sample holder at 39°C and then inserted an electrode directly into a B-corpuscle through the smooth muscle layer. A bioelectrical change was recorded by means of a D.C. amplifier and an E.M. recorder. They also took an internal B-duct, separated from a rabbit, placed it on electrodes in a glass tube or in a damp chamber containing serum-saline solution and then connected it with silver-chloride electrodes. In both cases, the specific bioelectric changes were similar. They find three types of basic waves of amplitude ~0.1mv; i.e., with periods 3-6 sec(ア), 7-10 sec(イ) and 20-25 sec(ウ), which generally subside within 30-40 minutes. These waves are mixed and arranged in groups such as illustrated in Fig. 24. In some instances, only a single wave prevails.

Fig. 24

Chart recording illustration the mixing of three basic electrical potential waves.

When the temperature is reduced below 25[C, the electrical changes completely disappear. However, they reappear again when the temperature is raised to 39ℓC immediately after their disappearance. Since these electrical effects have been observed in corpuscles and ducts, separated from the body, and endure for a certain length of time, it is unlikely to be accounted for by a neural reflective mechanism.

Experiments have been carried out using different chemicals to stimulate either the corpuscle or duct. Immediately after drippping pilocarpine solution or acetylcholine on a corpuscle, the bioelectrical activity grew feeble for a time and then, all at once, began to grow vigorously and become still stronger after 30 minutes. Generally, in this case, the wave prevails. The length of time between the application of chemicals and the appearance of fluctuations on the electrogram (and the character of the reaction) differs according to the variety and concentration of chemicals and to the state of the corpuscle or duct prior to the application of chemicals.

They have treated the corpuscle with stimuli of different intensity using needle, moxacautery and chemicals and find (a) when a strong stimulus is given, in the case where the electrical voltage is intensified, (b) when a strong stimulus is given, when the before stimulus voltage was already strong, it produces no effect at all or slightly decreases the voltage, (c) when the electrical voltage has become weak due to strong stimulation, it cannot be increased significantly even by giving stronger stimuli repeatedly, but if a proper weak stimulus is given, the voltage will pick up.

When they monitor bioelectrical changes of one corpuscle and give a stimulus to the adjacent corpuscle on the same duct, on either the cranial or caudal side, they find voltage changes take place some time later at the monitored corpuscle. The propagation velocity in both directions was about 0.3 cm per sec, almost 3 to 4 orders of magnitude smaller than nerve propagation rates. They find that a weak stimulus propagates only to the adjacent corpuscle whereas the effect of a stronger stimulus is propagated also from the second to the third. However, an excessively strong stimulus fails to propagate any effect even to the adjacent corpuscles. When a stimulus is given first to the second corpuscle in a line of corpuscles and then another stimulus is given to the first one, the effect of the stimulus to the first one, comparatively weak as it may be, is felt by the second one and then conducted to the third.

4. Mechanical Effects

Using a microscope, the autonomic movements of an internal duct were observed and investigated. They observed an incessant or periodic movement in the longitudinal direction, a quick, trembling and pulsating movement in the transverse direction and an undulating movement made which is a mixed form of these two. The type and magnitude of the movements of a freshly isolated duct are quite dependent upon the conditions of the organism prior to isolation. By also recording bioelectric changes, it was found that the mechanical movements are always preceded by bioelectric changes for a period of time. If the movements of the duct are activated and made more frequent by chemical stimuli, the preceding electrical voltage is also intensified; however, if the movements are suppressed by chemical stimuli, the electrical voltage is also weakened. It seems that a type of electrochemical and piezoelectric transduction may be occurring here.

5. Some Miscellaneous Stimulation and Incision Effects

Drug stimulation to the internal B-ducts, chiefly in the artery and vein of the cervical and femoral regions, was found to effect the number of heart beats and the force of cardiac contraction and

brought about movements of the intestines. It also was found to exert tangible influence on the ergogram of skeletal muscle.

A variety of interesting effects were observed when B-ducts are cut. These are (a) when this happens to the terminal duct, karyolsis occurs in the tissue cells connected to the duct and the cells die, (b) when the B-duct of the peripheral nerve is cut, the excitability of the nerve decreases remarkably and (c) when the B-duct of the motor nerve is cut and repeated stimulation is given to this nerve, the muscle ceases to contract within a short span of time (1-6 hours).

6. Biochemical Studies

Superficial B-corpuscles and intravascular B-ducts were collected, homogenized and analyzed for DNA and RNA content. Table I present the DNA content of rabbit tissue, and the ratio of DNA to RNA in the corpuscles was about 6:1 whereas in the ducts it was about 1.5:1. We may notice from Table I that the corpuscles and ducts contain more nucleic acids than any other tissues. A B-duct of a rabbit was isolated, dissolved in citric acid-sucrose solution, the walls and nuclei of the duct removed from solution and the remaining liquor studied. As seen in Table II, the B-liquor

Table I. DNA content in rabbit tissues

Tissue	Content of DNA (mg%)
Bonghan corpuscle	2,000
Bonghan duct	2,300
Liver	153
Spleen	700
Kidney	119
Blood	35

Table II. Contents of total nitrogen, nonprotein nitrogen, lipids and reduced sugar (%)

Total nitrogen	3.12 - 3.40
Nonprotein nitrogen	0.10 - 0.17
Lipids	0.57 - 1.00
Reduced sugar	0.10 - 0.12

contains much protein and non-protein nitrogen and considerable amount of sugar. In Table III, the total hyaluronic acid content is given and we see that, compared to other tissues, the B-liquor contains nearly as much hyaluronic acid as contained in cattle sperm and 25 times as much as in a clot of blood. Table IV illustrates the free amino acid content of B-liquor and shows that it contains 20 kinds including all the essential amino acids. They have found that B-liquor contains more than 16 kinds of mononucleotides, corticosteroid, 17-ketosteroid, estrogen and adrenalin. As shown in Table V, over twice as much adrenalin was found in the B-liquor as in blood and over 10 times as much was found in a superficial corpuscle as in blood.

As mentioned earlier, they have isolated both desoxyribonucleic acid and ribonucleic acid from the liquor. in a superficial corpuscle as in blood.

As mentioned earlier, they have isoalted both desoxyribonucleic acid and ribonucleic acid from the liquor. Paper chromatogram of the bases of DNA showed: (1) Guanine, (2) Adrenine, (3) Cytosine, (4) Thymine in similar proportions (2 and 4 were 25% greater than 1 and 3). Paper electrophoregram of the RNA showed: (1) Cytidylic acid, (2) Adenylic acid, (3) Guanylic acid, (4) Uridylic acid also in similar proportions (1 and 3 were 30% greater than 2 and 4). The existence of hyaluronic acid, cortical and medullary hormones and estrogen suggest that the meridian system is closely associated with the endocrine system.

Table III. Content of total hyaluronic acid (mg %)

Name of material	Ehrlich's direct-method		Ion exchange chromatography	
	Found	In literature	Found	In literature
Bonghan liquor	301.2±20.1	–	170.4±4.5	–
Clot of blood	39.7± 5.2	–	7.3±0.8	–
Rat liver	116.3± 4.5	–	47.0±2.5	30
Rabbit liver	41.0± 3.1	–	18.4±3.5	–
The white	105.6± 7.0	100	41.6±1.5	33
Yolk	320.0±30.2	350	60.1±1.7	61
Sperm of cattle	380.2±27.7	420	178.3±7.8	186

Table IV. Free amino acids in Bonghan liquor (mg %)

Amino acids	Content	Amino acids	Content
Leucine + Isoleucine	14.56 ± 0.84	Asparagin	0.85 ± 0.04
Phenylalanine	4.92 ± 0.87	Lysine	4.14 ± 0.76
Valine + Methionine + Tryptophane	15.07 ± 1.45	Arginine	7.45 ± 0.91
Tyrosine	1.85 ± 0.09	Aspartic acid	4.80 ± 0.33
Alanine	12.00 ± 1.20	Glutamine	0.98 ± 0.07
Glutamic acid	7.39 ± 0.48	Histidine	1.85 ± 0.09
Threonine	2.45 ± 0.45	Proline	–
Glycine + Serine	13.73 ± 2.32	Cystine	3.57 ± 0.24

Table V. Content of adrenalin and noradrenalin (r/g)

Sample	Found		In literature	
	Adrenalin	Noradrenalin	Adrenalin	Noradrenalin
Bonghan liquor	0.22 - 0.40	0.60 - 1.50	–	–
Superficial Bonghan corpuscle	0.92 - 1.92	2.20 - 3.90	–	–
Heart	0.08 - 0.18	0.69 - 1.40	0.04 - 0.10	0.70 - 1.30
Blood	0.10 - 0.13	–	–	–

7. Embryological Studies

Systematic observations were made on chick embryos incubated for different lengths of time in order to clarify the formation of the B-ducts relative to other vessels. The process of formation of the B-duct includes the following stages: (a) the stage of the primative cell of the B-duct (incubated for 7-8 hours), (b) the stage of the primordium of the B-duct (incubated for 10 hours), (c) the stage of the primative B-duct (incubated for 15 hours), (d) the stage of completing the B-ductules (incubated for 20-28 hours), (3) the stage of formation of the B-duct (incubated for 48 hours). The fact that the B-duct, with a basically completed tubular structure, develops in the embryo of 10-15 hours incubation, in which the primordia of organs are not yet differentiated, suggests that the function of the meridian system exerts an influence upon the differentiation of cells, organogenesis and histogenesis of the organism. We note that the B-ducts not only develop earlier but complete differentiation and formation occurs more rapidly than the blood vessels and nerves. It was also found that such basophile granules as are visible in the B-duct are also found in the chick embryo of the earliest stage of its development.

Having conducted experiments an mammals, aves, reptiles, amphibia, pisces, invertebrates and hydra, Bong Han suggests that the meridian system exists in all multicellular structures both animal and vegetable.

8. Corpuscle Function in Cell Generation

In the course of studying the physiological functions of the meridian system, they have ascertained that unique granules (called "Bonghan sanal") circulate in the system and that these grow into cells. Further, the cells of organs and tissues turn back into B-sanal while moving through the meridian system. This process is repeated in a continuous cycle which constitutes a self-renovation of the organism. To investigate this, the structures of the internal B-corpuscles which were taken out of the same region of blood vessels were compared with each other and the discernable corpuscles in lymphatic vessels were observed through the wall for a long period of time. It is of interest to consider here the stages of development in the morphological dynamics of the B-corpuscles in lymphatic vessels (see Fig. 25).

First Stage: The B-corpuscle appears to be an opaque and milk-white clot and its boundary is not distinguished. Histological study of the corpuscle at this moment reveals a stage at which no cell element is to be seen except basophile granules in growth.

Second Stage: The B-corpuscle is milk-white or yellowish at times and opaque. Its outer layer is hardly recognizable. Basophile granules are scanty; basophile structures are crowded and a part of them grow into small nucleus-like structures.

Third Stage: The corpuscle resembles a cluster of fat globules. It is soft in consistency, has a smooth surface and a glittering appearance. Its connection with the B-duct and the formation of the outer membrane is recognizable. Basophile granules turn into small nucleus-like structures. The transition of small, nucleus-like structures to the form of a nucleus is also recognized (see Fig. 25).

Fourth Stage: The corpuscle is either semitransparent or transparent and greyish-yellow, its counter being well distinguished. Many lymphoid cells are found inside the corpuscle which is of an oval shape. As time goes on, the corpuscle becomes opaque and greyish-white and the shape of the outer membrane begins to change. By this time, large, medium and tiny lymphocytes are observed to have been fully grown (see Fig. 25). Mature cells thrust outwards through the holes of the destroyed outer membrane.

Techniques have been developed to extract B-sanal and B-liquor from corpuscles and ducts using a fine glass capillary fixed to a micromanipulator. The sanal is generally spherical in shape but sometimes oval and of a size about 1.2μ -

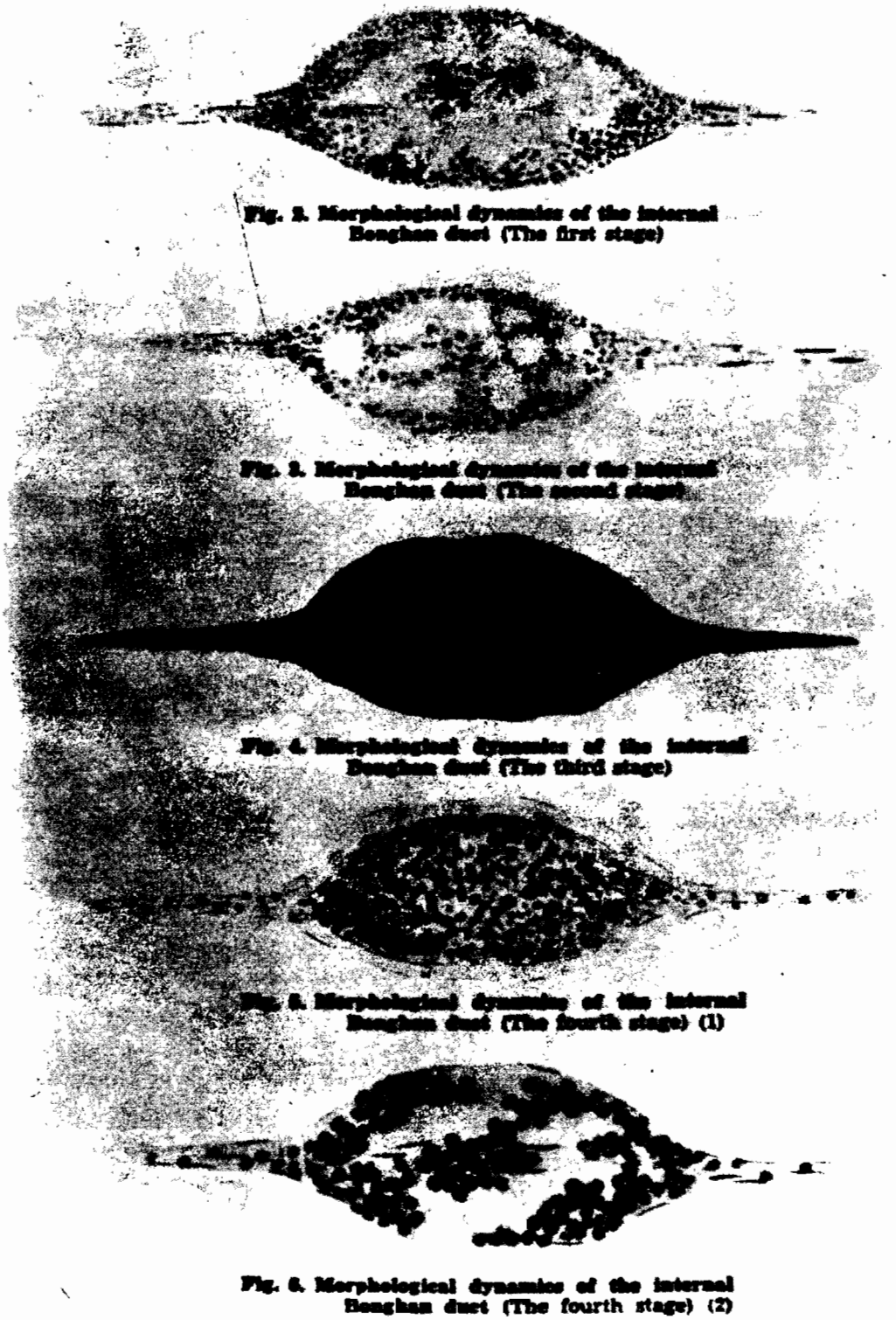

Fig. 25 Morphological dynamics of the internal Bonghan duct at different stages.

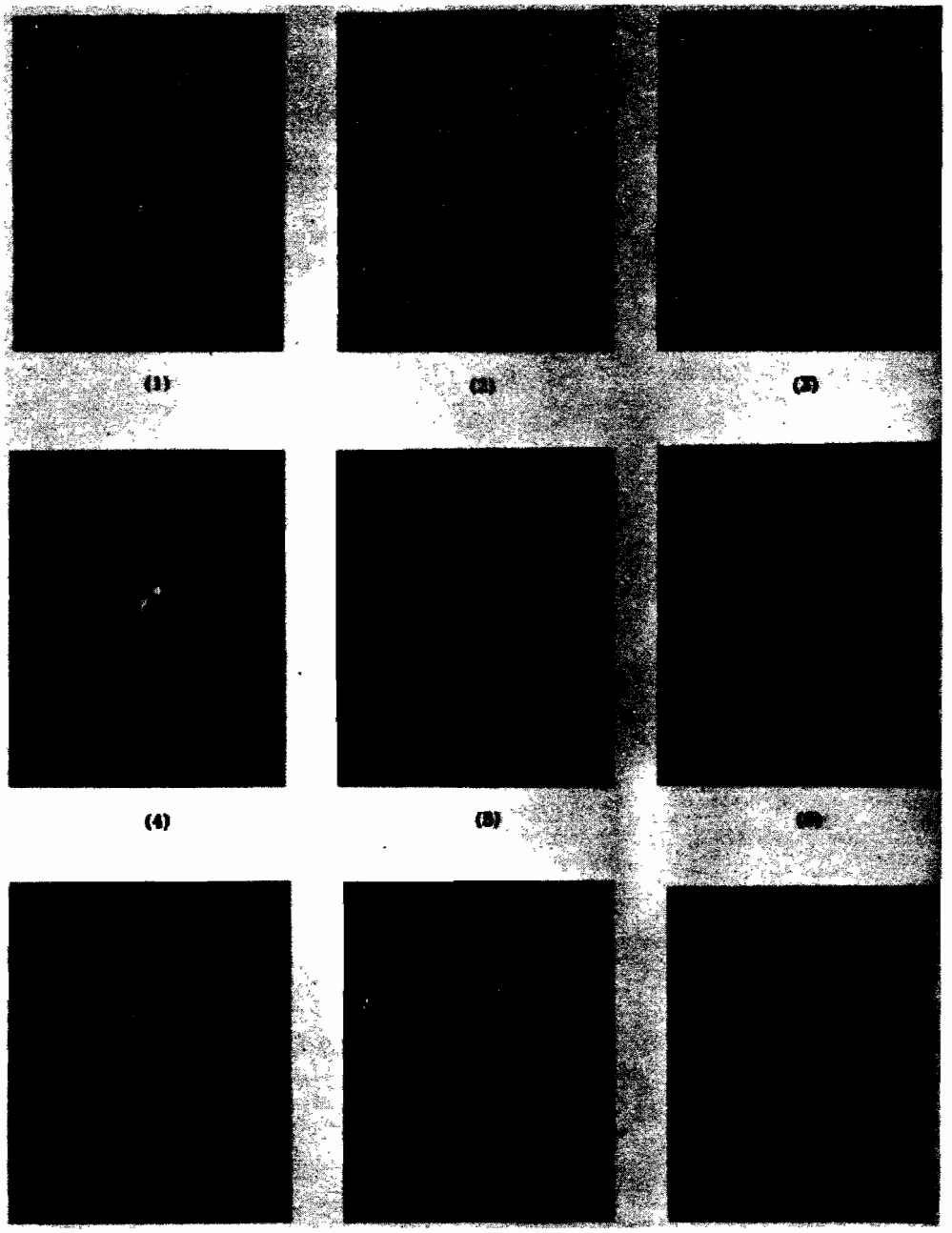

Fig. 26

Cell formation stage from sanal in the sanal-cell cycle.

1.5μ (smallest~ 0.8μ and largestM 2.4μ). When sanal particles placed in a culture media are observed under a phase contrast microscope, they are found to make a constant rotating movement. Further, one of the distinguishable parts of the sanal particle, called sanalosome, if found to move ceaselessly in the other part, called sanaloplasm. By analysis, it is found that almost all the DNA in the B-liquor is contained in the sanal particles and that the amount of DNA contained in one sanal particle is nearly equal to that contained in one chromo- becomes indistinct and the sanal unite with each other. However, the sanalosome still preserves its individuality. (2) A think membrane is formed around the fused structure which is called nucleus-like structure. (3) After the formation of the nucleus-like structures, homogeneous substance some. The sanaloplasm contains RNA.

In order to trace the processes of cell formation from sanal, a single sanal was cultivated in vitro and the development observed under the phase contrast microscope were cinematographed. Two main processes can be distinguished, (a) the stage of proliferation and (b) the stage of fusion. In the proliferation stage one sees the following: (1) In the course of movements of sanal sanalsome, changing itself into various forms, sends out a fine filiform process outside of the sanal membrane. (2) Around the filiform process appears sanaloplasm which gradually grows in size. This is called daughter sanal. It grows nearly as large as mother sanal. (3) The mother and daughter sanal form numerous other daughter sanal in the same way. The sanal thus formed are not separable because they are connected with each other by the filiform processes of sanalsomes. (4) Multiplied sanal present the appearance of a bunch of grapes (see Fig. 26). In the fusion stage, one sees the following: (1) The borderline between the different sanal becomes indistinct and the sanal unite with each other. However, the sanalosome still preserves its individuality. (2) A think membrane is formed around the fused structure which is called nucleus-like structure. (3) After the formation of the nucleus-like structures, homogeneous substance appears around it. This gradually grows and surrounds the nucleus-like structure. (4) The nucleus-like structure matures into a cell nucleus while the honogeneous substance around it is transformed into cytoplasm. At the same time, the cell membrane is also formed (see Fig. 26).

The process is that sanal flows in the meridian liquor. It forms by fusion into a cell and, after a limited life in an organ as a functioning cell, bursts through the cell membrane, breaks down and reenters the ducts to recirculate as sanal. The process steps of reconversion of a cell into sanal are as follows: (1) After a definite period of time, dot-like structures begin to move in the nucleus of the cultured cell. These black dot-like substances gradually make active movements, grow larger and form sanal. (2) Sanal which have been moving in the nuclei migrate into the cytoplasm after the disappearance of the nuclear membrane. Making active movements in the cytoplasm, sanal get bigger. (3) With the active movements of the sanal, the cell membrane expands and some time later it bursts to let the sanal out of the cell. Just before the rupture of the cell membrane, cytoplasmic substances can hardly be seen in the cytoplasm, only sanal and small black granules are observed. These stages are shown in Fig. 27. When a cell of normal tissue is separated from a living body, the same process of sanalization may be recognized in it and this process can be accelerated by various physico-chemical influences. The Bonghan sanal-cell cycle is illustrated in Fig. 28 and, in relationship to a B-corpuscle functioning as a manufacturing unit, in Fig. 29.

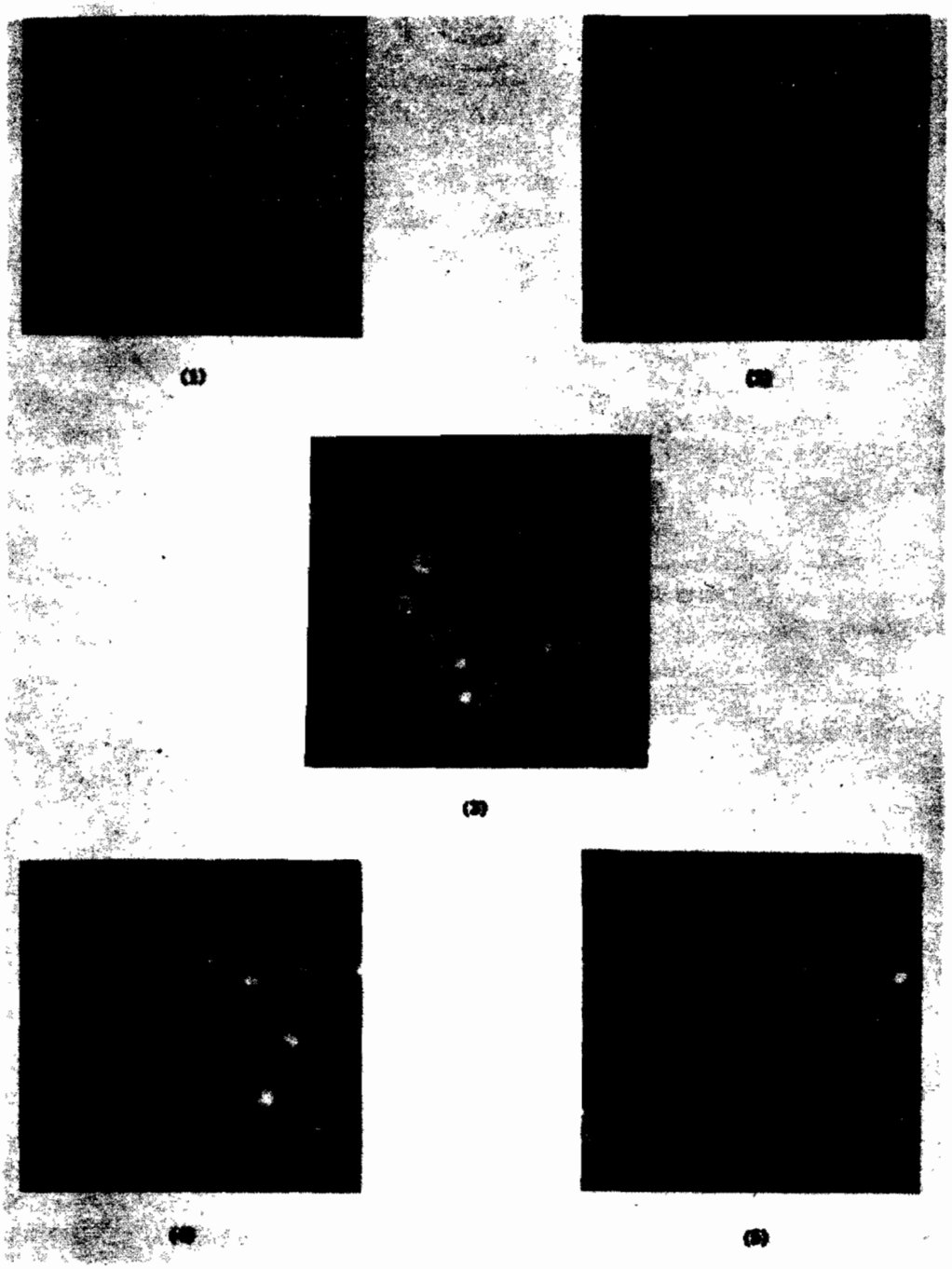

Fig. 27

Sanalization stage of the cell in the sanal-cell cycle.

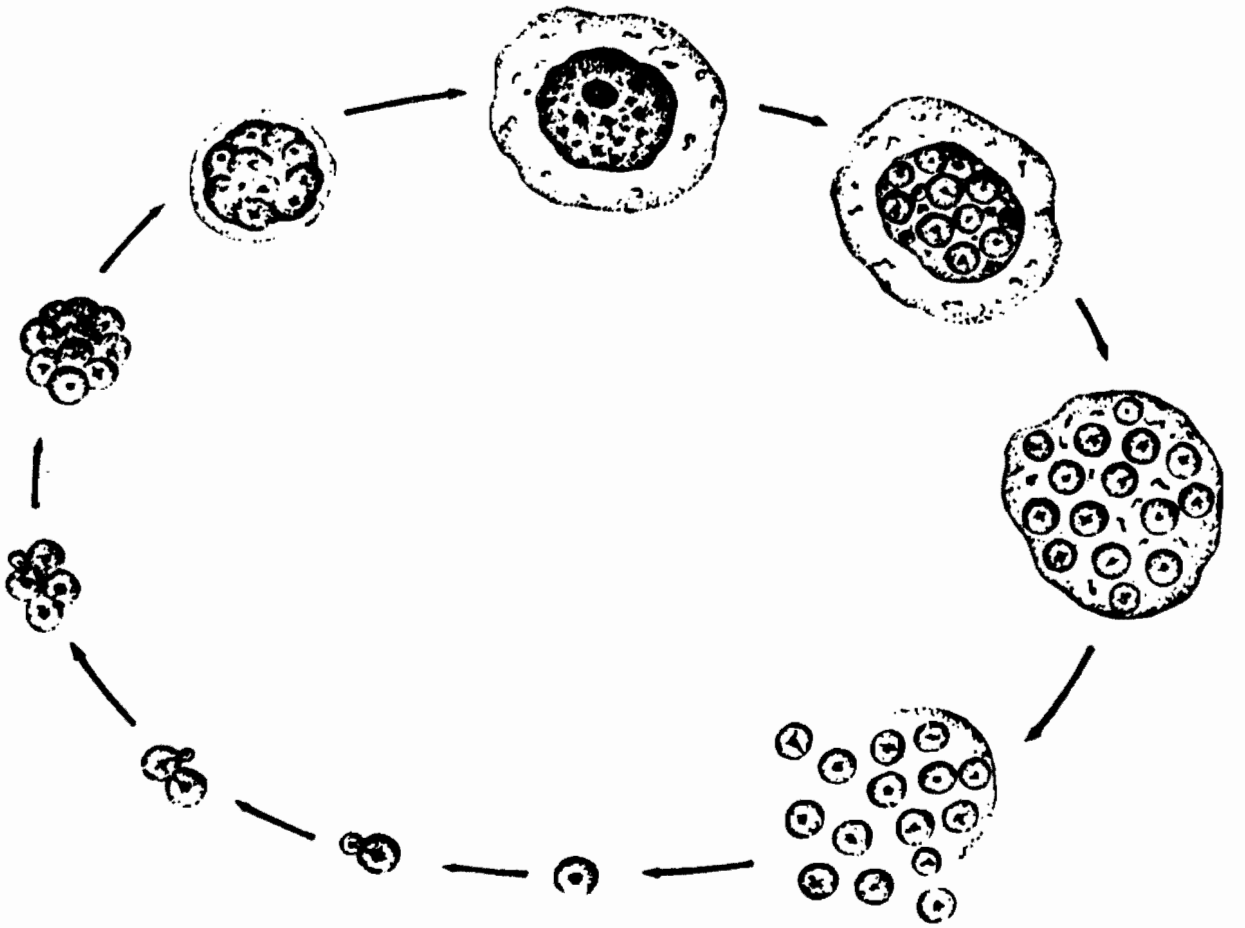

Fig. 28
Bonghan "Sanal-Cell" Cycle.

In the course of formation of a cell from sanal, the content of DNA is increased 16 times, RNA 9 times and protein nitrogen 32 times. With respect to cell divison, when the cell is a stable unit, the sanal is in a fused stage; however, during cell division it breaks down in such a way as to be suggestive of the behavior of chromosomes. In fact, the sanalosome appears to be equative to the chromosome (the amount of DNA in each is about equal and, when sanalization takes place within the nucleus, the number of sanalosomes is equal to that of chromosomes). This would suggest that cell division is a specific form of movement of sanal so that the inheritance of life atributed to chromosomes is an aspect of sanal and part of the organization of the meridians. To test this, sanal tagged with P^{32} was extracted from a superficial corpuscle and the extracted sanal was injected into different parts of the circulating ducts. Within 48 hours, tagged sanal could be detected amongst cell tissue. This experiment suggests that sanal from the corpuscles eventually become part of the cell tissue; i.e., from data on the ovary, the suprarenal body, the liver, the kidneys and the lungs.

Sanal and the different stages of its growth can be observed in all the B-ducts and B-corpuscles. Contrary to this, almost no sanal is found in blood, lymph and tissue fluid. In addition, all cells have a

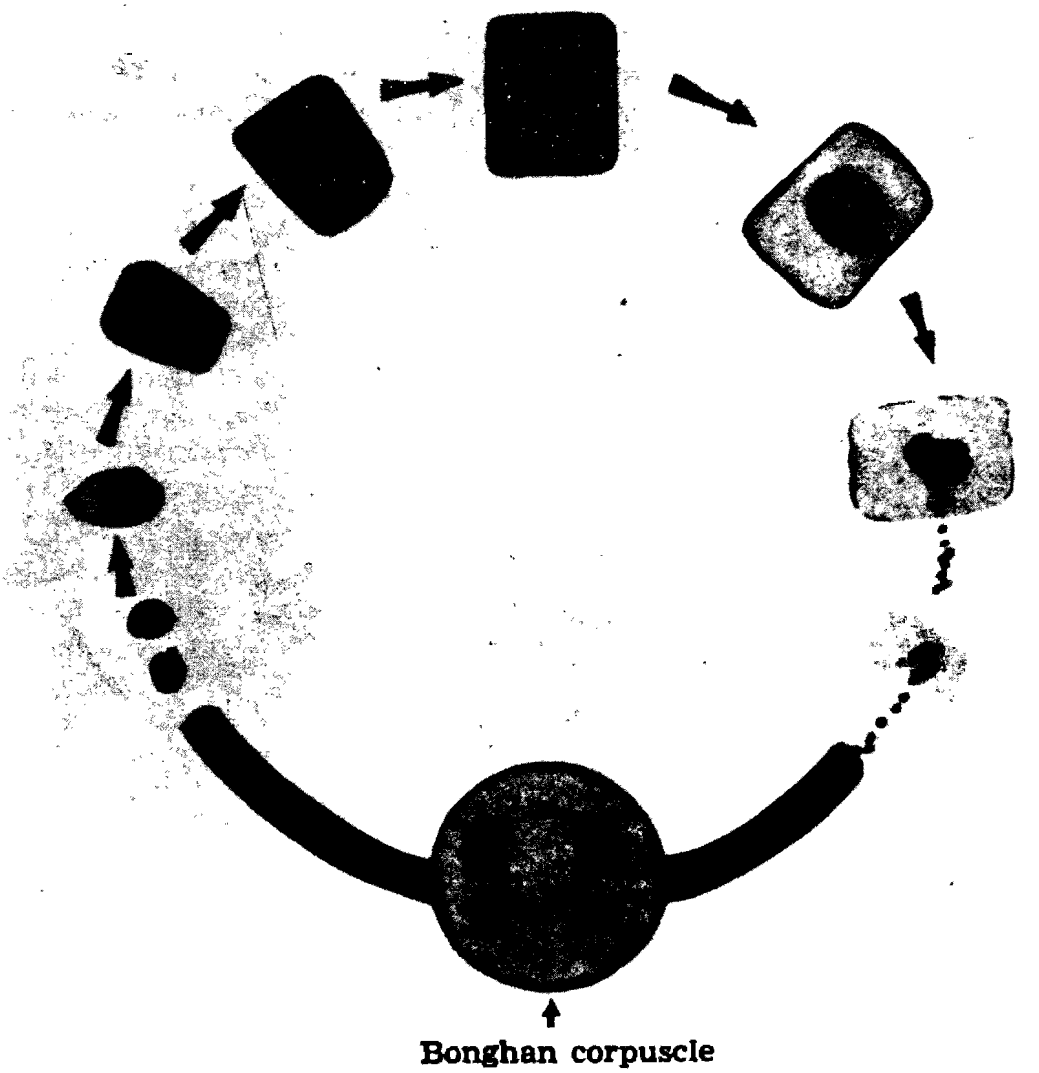

Fig. 29

Schematic diagram of cell formation from sanal and the danalization of cells.

sanal structure and can be sanalized. Finally, it seems that when a tissue cell is sanalized, the sanal become mature while moving, without exception, through the circulating course of the B-liquor.

In concluding this section, two important additional experiments are deserving of attention. First, Bonghan considered that, if the various acupuncture points (superficial corpuscles) have specific connections with relevant body organs and functions, then sanal taken from different corpuscles should produce different types of cells. They conducted a series of 344 experiments taking sanal from 79 different superficial corpuscles. As was expected, different cells were formed in accordance with the foci of these corpuscles. The second experiment touches the photo-chemical influence of light on the epidermis. They found that sanal cultivated under normal light grew 104

cells in 96 hours whereas, in a dark chamber, only 32 were formed. They attributed the few cells which did grow in the dark to having already been under the photo-chemical influence of light in the superficial corpuscles prior to being extracted from the ducts.

In Japan, a variety of institutions have undertaken some investigations of the Kim Bong Han theories and results [9]. The only results of these studies presently available to this author are a few of those reported by Fujiwara[9] (school of Medicine, City College of Osaka). He reports that the superficial corpuscles and the profound corpuscles on the surface of the lung, heart, liver, stomach, small and large intestine, spleen, kidney and bladder have been observed. He also describes an interesting staining technique which can be used on the human body: "Soak the part of the human body in methylene blue solution for 15-20 minutes. Rinse it with soap and warm water. Blue spots show up here and there on the skin. It is not clear whether these spots coincide with the acupuncture points but they all showed a lower resistance than the surrounding skin. Fujiwara indicates that the following groups are performing experiments,

Fujiwara indicates that the following groups are performing experiments, (1) Toho Medical College (anatomy), (2) Nagoya University (Oriental medicine study group), (3) Osaka University (physiology and anatomy), (4) City College of Osaka (Kyungrak theory study group), (5) Korean University in Tokyo (biology), (6) Tokyo University (physical therapy), (7) Tokyo College of Pharmacology (Chinese medicine study group). It is not known at present whether or not these studies have been actively pursued at these locations.

D. Summing Up

As we consider sections B and C, we note that the meridian system may be simply categorized in terms of (a) structure, (b) function and (c) characteristics of the network. Expanding this we have:

(a)*Network Structure,* 1.connections exist between all limbs of the network, 2. a special fluid (Chi) containing particulate matter (sanal) flows in the limbs of the circuits and develop certain one-way traffic routes, 3. the limbs of the circuits are interspersed with special interconnect stations (corpuscles) which have special functions, 4. some of these stations are interactive with internal body vessels, organs and systems, 5. some stations are interactive with the outer surface of the body in a network of points.

(b)*Network function,* 1. deals with the generation, distribution and reconversion of body cells, 2. probably acts as an organizing and cohering force for the other circulatory systems, 3. produces communication of specific growing pathology to surface points (like the diagnostic circuit at the surface of a large modern computer), 4. the flow path allows treatment of the duct fluid and particulates by solar radiation.

(c)*Network characteristics,* 1. manifested electrical properties (voltage, current, impedance, emission, which vary with physical, emotional and mental states of the organism, 2. multifaceted transducer action at the corpuscles (electro-chemical, electro-mechanical, chemico-mechanical, opto-electronic, etc.), 3. pathology is revealed by the generation of asymmetrical properties of the system (differential electrical resistance, differential thermal conductance, differentail pressure, etc.), 4. stimulation of surface network points (by pressure, heat, light, electricity, chemicals, etc.) moderates the asymmetrical properties.

In conclusion, let us consider a very simple model of what might be happening during normal acupuncture point stimulation and how it relates to anesthesia.

The energy Chi is thought to flow in the meridian circuitry. The fluid contains colloidal

particles (sanal) which are important energy components of the body. In general, the particle size is smaller but of similar order to the size of the tube through which it flows. Let us propose that if one upsets the energy fields of the body (because of a disharmony at the mind and spirit levels of substance), then conditions exist leading to colloid instability so that aglomeration rather than a stable dispersion is produced. Thus, the colloidal particles build a raft which tends to block the channels and provide resistance to the flow of fluid. The fluid in a certain section of pipe either slows down or stops completely and a pressure differential is developed between this limb of the circuit and a comparison unobstructed limb.

The function of the acupuncture stimulation is to break up these agglomerates. What probably happens is that these stimuli produce a type of capacitive energy effect, via transducer action, in the corpuscle which generates a force to draw the agglomerates along the pipe and disperse them. This may occur via a type of shock discharge which allows the fluid to get moving again and to develop momentum. When moving, the fluid has less inertia and this begins to bring about a rebalancing of the circuitry. We could discuss the kinds of forces in terms of electroendosmosis effects if we wished; however, the available data do not justify this modeling leap and we are better advised to stick to the simpler picture for a time.

If we look at the situation of anesthesia via needle insertion in a particular point, we expect that this might divert the flow of energy into other subsidiary channels. In turn, this is expected to produce a field effect which can act in at least two ways. It may act on the various important nerve centers so that the local energy fields are reduced to a point that the nerve firing does not occur. That is one possibility! The other relates to transmission line blockage; the nerve signals that normally go to the brain are blocked so that, although the nerves are firing, the information does not get through.

In addition, one must go deeper into this in the future because one must understand why we have a type of sterilization effect operating here. We hear of people eating oranges during surgery and it seems quite remarkable that this absence of what we think of as the need for proper sterlization in the operating room does not lead to any problems. This may be because we are dealing with another level of energy here (just as in the healer-patient experiments) and, if we deal with these other levels of energy, perhaps we can provoke energy alternations that eliminate the need for sterilization procedures.

As a final comment, let us proceed at the maximum possible rate to effectively reproduce and integrate the teachings concerning acupuncture that come to us from the East. Further, let us try to do this without destroying the holistic philosophy of healing that comes along with it!

William A. Tiller, PhD

"Some Physical Network Characteristics of Acupuncture Points and Meridians"

William A. Tiller, Ph.D., Stanford University professor and chairman of the Department of Materials Science at Stanford from 1966 to 1971, is a consultant to government and industry in the fields of metallurgy and solid state physics. He has published more than 100 scientific papers, has five patents issued, and has a definitive text on the Science of Crystallization in preparation, an area in which he is an international authority. A Director of the Academy of Parapsychology and Medicine, he is an associate editor for two scientific journals. In 1970 he was awarded a Guggenheim Fellowship for a year's study at Oxford University, England. He has two books in progress, one on the subject of "Concepts and Models for Understanding the Transformation of Man."

Dr. Tiller recently toured Europe and Russia, observing various aspects of unorthodox healing. He is presently studying the electrical changes that take place at acupuncture points during the healing process.

Dr. Tiller will propose a colloid stability model for rationalizing the efficacy of acupuncture point stimulation on the vitality level of particular body glands and systems.

A discussion will be given of some Russian instruments plus experiments on the measurement of electrical resistance, voltage, current and energy emission characteristics of acupuncture points during conditions of well-being, ill health, emotional and mental stimulation, etc. The use of Kirlian photography as a tool for gaining information concerning the energy nature of the meridian system will also be presented.

Attention will be focused on the revealing experiments of Professor Kim Bong Han which appear to have (a) delineated the morphology and environmental structure of the acupuncture meridians and the active elements of the acupuncture points, (b) measured the circulation of a fluid within the meridians independent of the other major body circulatory systems and (c) outlined the biochemical and histo-chemical study of the overall system.